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EXAMINER
HO, CHUONG T

ART UNIT	PAPER NUMBER
2616	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/035,027	ZHUANG ET AL.	
	Examiner	Art Unit	
	CHUONG T. HO	2616	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 03 February 2006.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-8,10-19,22,23,28 and 29 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) 19,22,23,28 and 29 is/are allowed.

6)☒ Claim(s) 1-8 and 10-18 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

1. The amendment filed 02/03/06 have been entered and made of record.

2. Applicant's arguments with respect to claims 1, 12, 17 have been considered but are moot in view of the new ground(s) of rejection.

3. Claims 1-8, 10-11, 12-16, 17, 18, 19, 22, 23, 28, 29 are pending.

Response to Arguments

The Applicant alleged that "Wu therefore necessarily teaches that an encoder map adjacent bits in each sub-segment to so-called "sub-symbols" and that this mapping occurs before the distribution of such symbols to the provided antennas. This approach is opposite to that set forth by the applicant. The present application teaches instead that adjacent bits are distributed over differing antennas and sub-carriers before any corresponding symbols are formed. Therefore, by the current application, symbol mapping occurs after Wu's multiplexer 105 instead of before" (See page 12, lines 10-15).

Applicant's arguments have been fully considered but they are not persuasive.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., map, mapping, symbol mapping) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1, 12, 17, 19 are rejected under 35 U.S.C. 102(e) as being anticipated by Ling et al. (U.S.Patent No. 6,771,706 B2).

In the claim 1, Ling et al. discloses providing a datastream comprised of bits (see figure 2A, col. 6, lines 38-52, encoder 202 receives and encodes the information bits in accordance with a particular encoding scheme to provide coded bits); comprising:

- Interleaving (see figure 2A, col. 6, lines 42-43, channel interleaver 204) the bits of the datastream across a plurality of orthogonal frequency division multiplexing radio frequency transmitters (modulator 122a, modulator 122t) (see fig.2A, col. 7, lines 58 - 61, a demultiplexer 214 demultiplexes the received modulation symbols into a number (N (T)) streams of modulation symbols, one stream for each antenna used to transmit the modulation symbols. Each stream of modulation symbols is provided to a respective modulator 122), wherein each of the radio frequency transmitters (fig. 2A, 122a, 122T) transmits a plurality of radio frequency subcarriers to provide interleaved bits (see col. 7, lines 63-66,

each modulator 122 converts the modulation symbols into an analog signal, and further amplifies, filters, quadrature modulates, and upconverts the signal to generate a modulated signal suitable for transmission over the wireless link);

- Wherein adjacent bits are assigned to different transmitters and different subscarriers (see figure 4, figure 2A, col. 10, lines 61-67, demultiplexer 408 demultiplexes the input data into a number of (K) channel data stream B(1) through B (K) “different channel data stream for each transmitters”. Each channel data stream may correspond to a signaling channel, a broadcast channel, a voice call, or a packet data transmission) (see col. 6, lines 46-49, symbol mapping element 208 maps the unpuntured coded bit into modulation symbols for one or more transmission channels used for transmitting the data);
- Transmitting data that corresponds to the interleaved bits using the plurality of radio frequency subscarriers of the plurality of orthogonal frequency division multiplexed radio frequency transmitters (122a..122t) (see col. 7, lines 63-66, each modulator 122 converts the modulation symbols into an analog signal, and further amplifies, filters, quadrature modulates, and upconverts the signal to generate a modulated signal suitable for transmission over the wireless link);

6. In the claim 12, see figure 1, Ling et al. discloses an encoder (fig.2A, encoder 202) having a single datastream input and an encoded bits datastream output (see fig.2a, col. 6, lines 38-39); comprising:

- A multiple-input multiple-output modulator (figure 2A, DEMUX 214) having an input operably coupled to the encoded bits datastream output of the encoder (fig.2A, encoder 202) and having a serial-to-parallel output that provides first (fig. 2A, MOD 122a) and second (fig.2A, MOD 122t) items of modulation information that corresponding to the encoded bits (see col. 7, lines 58-67);
- A first orthogonal frequency division multiplexed transmitter (fig.2A, MOD 122a) having an input operably coupled to a first output of the serial-to-parallel output of the multiple-input multiple-output modulator (fig.2A, DEMUX 214) to receive the first items of modulation information (see col. 7, lines 58-67);
- A second orthogonal frequency division multiplexed transmitter (fig.2A, 122t) having: an input operably coupled to a second output of the serial-to-parallel output of the multiple-input multiple-output modulator (fig.2A, DEMUX 214) to receive the second items of modulation information (see col. 7, lines 58-67); and a multiple subcarrier radio frequency transmission output (fig.2A, 124a..124t, col. 7, lines 58-67);
- Such that information comprising the encoded bits datastream (see col. 7, lines 42-44, channel interleaver 204) are interleaved across the multiple subcarriers of the first (fig.2A, 122a) and second (fig.2A, 122t) orthogonal

frequency division multiplexed transmitters (see col. 7, lines 58-67) with adjacent datastream output bits being assigned to different ones of the transmitters (fig. 2A, MOD 122a, 122t) and to different ones of the subcarriers (fig.2A, 124a,..., 124t) (see figure 4, figure 2A, col. 10, lines 61-67, demultiplexer 408 demultiplexes the input data into a number of (K) channel data stream B(1) through B (K) "different channel data stream for each transmitters". Each channel data stream may correspond to a signaling channel, a broadcast channel, a voice call, or a packet data transmission) (see col. 6, lines 46-49, symbol mapping element 208 maps the unpuntured coded bit into modulation symbols for one or more transmission channels used for transmitting the data).

7. In the claim 17, Ling et al. discloses providing a first (fig.2A, 122a) and second (fig.2A, 122t) orthogonal frequency division multiplexed transmitter wherein each transmitter transmits a plurality of subcarriers (see col. 7, lines 58-67) at frequencies that are substantially identical as between the first (fig.2A, 122a) and second (fig.2A, 122t);

Providing a single stream of data comprised of sequential bits (see fig.2A, col. 6, lines 30-33);

Interleaving (fig.2A, see col. 6, lines 42-44, interleaver 204) the sequential bits across the plurality of subcarriers (see fig.2A, col. 7, lines 58-67) for both the first (fig.2A, 122a) and second (fig.2A, 122t) orthogonal frequency division multiplexed transmitters (see col. 7, lines 58-67) with adjacent sequence bits being assigned to differing ones of the

transmitters (fig.2A, 122a...122t) and differing ones of the subscarriers (see figure 4, figure 2A, col. 10, lines 61-67, demultiplexer 408 demultiplexes the input data into a number of (K) channel data stream B(1) through B (K) "different channel data stream for each transmitters". Each channel data stream may correspond to a signaling channel, a broadcast channel, a voice call, or a packet data transmission) (see col. 6, lines 46-49, symbol mapping element 208 maps the unpuntured coded bit into modulation symbols for one or more transmission channels used for transmitting the data).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 2-8, 10-11, 13-16, 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ling et al. (U.S.Patent No. 6,771,706 B2) in view of Sarraf et al. (U.S.Patent No. 6,747,948 B1).

In the claim 2, Ling et al. discloses the limitations of claim 1 above.

However, Ling et al. is silent to disclosing providing datastream comprised of bits includes providing a datastream comprised of bits as provided from a single source.

Sarraf et al. , see figure 2, discloses the signal generation unit modulates a plurality of subcarriers, which may be OFDM sub-carriers, based on the interleaved substream and upconverts the modulated subcarriers for transmission (see col. 2, lines 32-35); comprising:

- providing datastream comprised of bits includes providing a datastream comprised of bits as provided from a single source (see col. 2, lines 20-22, the encoder receives blocks of source data from one or more data sources).

Both Ling and Sarraf discloses an orthogonal frequency division multiplexing (OFDM). Wu recognizes providing datastream comprised of bits includes providing a datastream comprised of bits as provided from a single source. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Ling with the teaching of Sarraf to provide providing datastream comprised of bits includes providing a datastream comprised of bits as provided from a single source in order to improve the performance of error correction decoders.

10. In the claim 3, Sarraf et al. discloses provising a datastream comprised of bits includes providing a datastream comprised of bits as provided from a plurality of sources (see col. 2, lines 20-22, the encoder receives blocks of source data from one or more data sources).

11. In the claim 4, Sarraf et al. discloses providing a datastream comprised of bits as provided from a plurality of sources (see col. 2, lines 20-22, the encoder receives blocks of source data from one or more data sources) includes providing a datastream comprised of bits as provided from a plurality of sources (see col. 2, lines 20-22, the

encoder receives blocks of source data from one or more data sources) wherein at least some of the bits as provided from at least one of the plurality of sources are encoded bits (encoding unit 16, see figure 2) (see col. 3, lines 27-55).

12. In the claim 5, Sarraf et al. discloses providing a datastream comprised of bits includes providing a datastream comprised of encoded bits (encoded data, see abstract) (see col. 3, lines 27-55).

13. In the claims 6, 13, 14, 15, Sarraf et al. discloses a datastream comprised of encoded bit includes providing a datastream comprised of convolutionally encoded bits (see col. 3, lines 27-55).

14. In the claim 7, Sarraf et al. discloses providing a datastream comprised of encoded bits includes providing a datastream comprised of serially concatenated convolutionally encoded bits (see col. 3, lines 27-55).

15. In the claim 8, Sarraf et al. discloses providing a datastream comprised of encoded bits includes providing a datastream comprised of parallel (see col. 3, line 21) concatenated convolutionally encoded bits (see col. 3, lines 27-55).

16. In the claim 9, See figure 1, Ling et al. discloses providing a datastream (see col.4, lines 25-27) comprising of encoded bits includes providing a datastream comprised of encoded bits (FEC Encoder 102) (see col. 4, lines 30-35); and interleaving (interleaver 103) the bits of the datastream across a plurality of orthogonal frequency division multiplexed radio frequency transmitters (106, 116, 126) includes interleaving the encoded bits of the datastream across the plurality of orthogonal frequency division multiplexed radio frequency transmitters (106, 116, 126) (see col. 4, lines 37-49).

17. In the claim 10, Sarraf et al. discloses interleaving the encoded bits of the datastream includes alternating assignment of consecutive encoded bits to the radio frequency transmitters and on a plurality of the subcarriers having channel responses with low correlation (see col. 3, lines 57-67, col. 4, lines 1-5).

18. In the claims 11, 16, Sarraf et al. discloses transmitting data that corresponds to the interleaved bits includes transmitting symbols wherein each symbol represents a plurality of the interleaved bits (see col. 3, lines 57-67).

19. In the claim 18, Ling et al. discloses interleaving (see figure 1, interleaver 103) the sequential the sequential bits across the plurality of subcarriers of both the first (106) and second (116) orthogonal frequency division multiplexed transmitters includes interleaving the sequential bits across the plurality of subcarriers (see col. 4, lines 37-49) for both the first (106) and second (116) orthogonal frequency division multiplexed transmitters such that consecutive encoded bits of each datastream will be transmitted from transmitters and subcarriers with substantially minimal correlation (see col. 6, lines 66-67).

20. In the claim 20, Sarraf et al. discloses de-interleaving the bit metrics of the single bit stream (see col. 6, line 35).

21. In the claim 24, Sarraf et al. discloses decoding (decoding unit 60) to recover at least one information source based on the de-interleaved bit metrics (58) (see col. 7, lines 15-30).

22. In the claim 25, Sarraf et al. discloses decoding includes serially concatenated convolutionally decoding the single stream of data (see col. 7, lines 15-30).

23. In the claim 26, Sarraf et al. discloses decoding includes parallel concatenated convolutionally decoding the single stream of data (see col. 7, lines 15-30).

24. In the claim 27, Sarraf et al. discloses decoding includes convolutionally decoding the single stream of data (see col. 7, lines 15-30).

Claim Rejections - 35 USC § 102

25. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

26. Claims 1, 12, 17 are rejected under 35 U.S.C. 102(e) as being anticipated by Zhuang et al. (U.S.Patent No. 2003/0112745 B1).

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

27. In the claim 1, Zhuang et al. discloses providing a datastream comprised of bits (see figure 2, bits 205) (see figure 2, page. 2, [0017],to achieve this minimum diversity

factor within one embodiment of the invention, each one of d (free) adjacent bits may be mapped to different symbols that are sent on different OFDM subscarriers after being first processed (in another embodiment of the invention) by the transmit array processor 270); comprising:

- Interleaving (bit interleaver 215) the bits of the datastream across a plurality of orthogonal frequency division multiplexing radio frequency transmitters (OFDM transmitters 245) (see figure 2, page. 2, [0020], the transmit array processor 270 processes the symbols 235 and may compute a plurality of array-processed symbols 242 that can be fed to a plurality of OFDM transmission units 245. Each output of an OFDM transmission unit may be connected to a transmit antenna 280. One processor 270 to exploit any spatial diversity that may be present in the multipath channel), wherein each of the radio frequency transmitters (OFDM transmitters 245) transmits a plurality of radio frequency subcarriers (see page 2, [0017], for another embodiment of the transmitter 200 where different modulations are used on <u>different subcarriers</u>, the bit-to-symbol mapping operation of BICM needs to be performed in a manner consistent with the modulation being used, but the diversity factor d (free) can still be achieved if the bit-interleaver is designed properly) to provide interleaved bits wherein adjacent datastream bits are assigned to different transmitters and different subscarriers (see figure 2, page. 2, [0017],to achieve this minimum diversity factor within one embodiment of the

invention, each one of d (free) adjacent bits may be mapped to different symbols that are sent on different OFDM subscarriers after being first processed (in another embodiment of the invention) by the transmit array processor 270);

- Transmitting data that corresponds to the interleaved bits using the plurality of radio frequency subscarriers of the plurality of orthogonal frequency division multiplexed radio frequency transmitters (OFDM transmitters 245) (see figure 2, page. 2, [0020], the transmit array processor 270 processes the symbols 235 and may compute a plurality of array-processed symbols 242 that can be fed to a plurality of OFDM transmission units 245. Each output of an OFDM transmission unit may be connected to a transmit antenna 280. One processor 270 to exploit any spatial diversity that may be present in the multipath channel) (see page 2, [0017], for another embodiment of the transmitter 200 where different modulations are used on <u>different subcarriers</u>, the bit-to-symbol mapping operation of BICM needs to be performed in a manner consistent with the modulation being used, but the diversity factor d (free) can still be achieved if the bit-interleaver is designed properly);

28. In the claim 12, see figure 2, Zhuang et al. discloses an encoder (210) (see figue 2, the information bit sequence 205 may be encoded 210 by a convolutional code or a turbo code) having a single datastream input and an encoded bits datastream output (see page. 2, [0015]); comprising:

- A multiple-input multiple-output modulator (a transmit array processor 270) having an input operably coupled to the encoded bits datastream output of the encoder (see figure 2, [0015], encoder 210) and having a serial-to-parallel output that provides first and second items of modulation information that corresponding to the encoded bits(see figure 2, page. 2, [0017],to achieve this minimum diversity factor within one embodiment of the invention, each one of d (free) adjacent bits may be mapped to different symbols that are sent on different OFDM subscarriers after being first processed (in another embodiment of the invention) by the transmit array processor 270);
- A first orthogonal frequency division multiplexed transmitter (OFDM transmitter 245) having an input operably coupled to a first output of the serial-to-parallel output of the multiple-input multiple-output modulator (270) to receive the first items of modulation information; and a multiple subscarrier radio frequency transmission output (see figure 2, page. 2, [0020], the transmit array processor 270 processes the symbols 235 and may compute a plurality of array-processed symbols 242 that can be fed to a plurality of OFDM transmission units 245. Each output of an OFDM transmission unit may be connected to a transmit antenna 280. One processor 270 to exploit any spatial diversity that may be present in the multipath channel) (see page 2, [0017], for another embodiment of the transmitter 200 where different modulations are used on <u>different subcarriers</u>, the bit-to-symbol mapping operation of BICM needs to be performed in a manner consistent with the

modulation being used, but the diversity factor d (free) can still be achieved if the bit-interleaver is designed properly);

- A second orthogonal frequency division multiplexed transmitter (OFDM transmitter 245) having: an input operably coupled to a second output of the serial-to-parallel output of the multiple-input multiple-output modulator (270) to receive the second items of modulation information(see figure 2, page. 2, [0020], the transmit array processor 270 processes the symbols 235 and may compute a plurality of array-processed symbols 242 that can be fed to a plurality of OFDM transmission units 245. Each output of an OFDM transmission unit may be connected to a transmit antenna 280. One processor 270 to exploit any spatial diversity that may be present in the multipath channel) (see page 2, [0017], for another embodiment of the transmitter 200 where different modulations are used on <u>different subcarriers</u>, the bit-to-symbol mapping operation of BICM needs to be performed in a manner consistent with the modulation being used, but the diversity factor d (free) can still be achieved if the bit-interleaver is designed properly);
- Such that information comprising the encoded bits datastream (see figure 2, encoder 210) are interleaved (see figure 2, bit interleaver 215) across the multiple subcarriers of the first and second orthogonal frequency division multiplexed transmitters (245) (see figure 2, page. 2, [0020], the transmit array processor 270 processes the symbols 235 and may compute a plurality of array-processed symbols 242 that can be fed to a plurality of OFDM

transmission units 245. Each output of an OFDM transmission unit may be connected to a transmit antenna 280. One processor 270 to exploit any spatial diversity that may be present in the multipath channel) (see page 2, [0017], for another embodiment of the transmitter 200 where different modulations are used on <u>different subcarriers</u>, the bit-to-symbol mapping operation of BICM needs to be performed in a manner consistent with the modulation being used, but the diversity factor d (free) can still be achieved if the bit-interleaver is designed properly).

29. In the claim 17, Zhuang et al. discloses providing a first and second orthogonal frequency division multiplexed transmitter wherein each transmitter (245) (see figure 2, page. 2, [0020], the transmit array processor 270 processes the symbols 235 and may compute a plurality of array-processed symbols 242 that can be fed to a plurality of OFDM transmission units 245. Each output of an OFDM transmission unit may be connected to a transmit antenna 280. One processor 270 to exploit any spatial diversity that may be present in the multipath channel) (see page 2, [0017], for another embodiment of the transmitter 200 where different modulations are used on <u>different subcarriers</u>, the bit-to-symbol mapping operation of BICM needs to be performed in a manner consistent with the modulation being used, but the diversity factor d (free) can still be achieved if the bit-interleaver is designed properly) transmits a plurality of subcarriers at frequencies that are substantially identical as between the first and second transmitter ;

Providing a single stream of data comprised of sequential bits (see figure 2, page 2, [0015]);

Interleaving (see figure 2, bit interleaver 215) the sequential bits across the plurality of subcarriers for both the first (106) and second (116) orthogonal frequency division multiplexed transmitters (see figure 2, page. 2, [0020], the transmit array processor 270 processes the symbols 235 and may compute a plurality of array-processed symbols 242 that can be fed to a plurality of OFDM transmission units 245. Each output of an OFDM transmission unit may be connected to a transmit antenna 280. One processor 270 to exploit any spatial diversity that may be present in the multipath channel) with adjacent sequential bits being assigned to different ones of the transmitters and differing ones of the subcarriers (see page 2, [0017], for another embodiment of the transmitter 200 where different modulations are used on <u>different subcarriers</u>, the bit-to-symbol mapping operation of BICM needs to be performed in a manner consistent with the modulation being used, but the diversity factor d (free) can still be achieved if the bit-interleaver is designed properly).

30. In the claim 2, Zhuang et al. discloses a datastream comprised of bits includes providing a datastream comprised of bits as provided from a single source (see figure 2, page 2, [0015], 205).

31. In the claim 5, Zhuang et al. discloses providing a datastream comprised of bits includes providing a datastream comprised of encoded bits (see figure 2, page 2, [0015], 210).

32. In the claim 6, Zhuang et al. discloses wherein providing a datastream comprised of encoded bits includes providing a datastream comprised of convolutionally encoded bits (see figure 2, page 2, [0015], 210).

33. In the claim 7, Zhuang et al. discloses wherein providing a datastream comprised of encoded bits includes providing a datastream comprised of serially concatenated convolutionally encoded bits (see figure 2, page 2, [0015]).

34. In the claim 8, Zhuang et al. discloses wherein providing a datastream comprised of encoded bits includes providing a datastream comprised of parallel concatenated convolutionally encoded data (see figure 2, page 2, [0015]).

35. In the claim 10, Zhuang et al. discloses assigning adjacent datastream bits to differing transmitters and differing subscarriers comprises assigning adjacent datastream bits to differing transmitters and differing subcarriers with low channel response correlation to thereby exploit an increased amount of spatial and frequency diversity (see figure 2, page. 2, [0017],to achieve this minimum diversity factor within one embodiment of the invention, each one of d (free) adjacent bits may be mapped to different symbols that are sent on different OFDM subscarriers after being first processed (in another embodiment of the invention) by the transmit array processor 270).

36. In the claim 11, Zhuang et al. discloses wherein assigning adjacent datastream bits to differing transmitters and differing subscarriers with low channel response correlation further comprises assigning adjacent datastream bits out of each encoder when multiple encoders are use to differing transmitters and different subcarriers with

low channel response correlation to thereby exploit an increased amount of spatial and frequency diversity of each encoded datastream (see figure 2, page. 2, [0017],to achieve this minimum diversity factor within one embodiment of the invention, each one of d (free) adjacent bits may be mapped to different symbols that are sent on different OFDM subscarriers after being first processed (in another embodiment of the invention) by the transmit array processor 270).

37. In the claim 13, Zhuang et al. discloses wherein the encoder comprises a serially concatenated convolutional encoder (see figure 2, page 2, [0015]).

38. In the claim 14, Zhuang et al. discloses wherein the encoder comprises a parallel concatenated convolutional encoder (see figure 2, page 2, [0015]).

39. In the claim 15, Zhuang et al. discloses wherein the encoder comprises a convolutional encoder (see figure 2, page 2, [0015]).

40. In the claim 16, Zhuang et al. discloses wherein the first and second items of modulation information that correspond to the encoded bits comprise symbols wherein each symbol represents a plurality of encoded bits (see figure 2, page 2, [0020]).

In the claim 18, Zhuang et al. discloses wherein interleaving the sequential bits (bit interleaver 215) across the plurality of subcarriers for both the first and second orthogonal frequency division multiplexed transmitters with adjacent sequential bits being assigned to differing ones of the transmitters and differing ones of the subscarriers (see page 2, [0017} includes interleaving the sequential bits across the plurality of subcarriers for both the first and second orthogonal frequency division multiplexed transmitters with adjacent sequential bits being assigned to differing ones of

the transmitters and differing ones of the subcarriers such that consecutive encoded bits of each datastream will be transmitted from transmitters (OFDM 245) and subcarriers with substantially minimal correlation (see page 2, [0015]).

Allowable Subject Matter

41. Claims 19, 22, 23, 28-29 are allowed.

42. The following is an examiner's statement of reasons for allowance: the prior art (6771706, 6747948, 6850481, 20030072254, 20020122381, 20030003880, 6771706, 20020191703) of record does not appear to teach or render obvious the claimed limitations in combination with the specific added limitations, as recited from independent claim 28: "wherein demodulation include the use of a zero forcing symbol metric estimator based on ('In" stands for the natural logarithm) In P (...) where S is the estimated symbol at the Kth subcarrier of the Jth transmitted antenna, i.e. [..] = w, yk with filter matrix Wk being the zero forcing matrix computed based on the channel matrix Hk and where Wk (:j) denoted the jth column of Wk "II.II" denotes the vector nome, O is the noise power, and S is any of the constellation symbols ".

43. The following is an examiner's statement of reasons for allowance: the prior art (6771706, 6747948, 6850481, 20030072254, 20020122381, 20030003880, 6771706, 20020191703) of record does not appear to teach or render obvious the claimed limitations in combination with the specific added limitations, as recited from independent claim 29: "wherein demodulation include the use of a minimum mean squared error symbol metric estimate based on ("In" stands for the natural logarithm....is the average symbol power, and S is any of the constellation symbols".

44. The following is an examiner's statement of reasons for allowance: the prior art (6771706, 6747948, 6850481, 20030072254, 20020122381, 20030003880, 6771706, 20020191703) of record does not appear to teach or render obvious the claimed limitations in combination with the specific added limitations, as recited from independent claim 19: "demodulating the received multi-antenna transmission signals to data bits from bit metrics computed by using a maximum likelihood bit soft information estimator represented by

P (Y (k) | B (I, k)) = Sum seSi (P (Y(k) | S (k) = S) P (S (k) = S)

Where P (Y (k) | B (I, k)) is a probability of observing received signals Y (k) at the Kth subscarriers on at least one antenna under the condition of transmitting bit B (I,k) (0 or 1), and S (i) a set of all symbol vectors whose bit representations contain the given value of the bit of interest B (I, k).

45. The following is an examiner's statement of reasons for allowance: the prior art (6771706, 6747948, 6850481, 20030072254, 20020122381, 20030003880, 6771706, 20020191703) of record does not appear to teach or render obvious the claimed limitations in combination with the specific added limitations, as recited from independent claim 22: "demodulating the received multi-antenna transmission signals to recover data bits from bit metrics computed by using a zero forcing bit metric estimator represented by

P (s (j, k) | B (I, k) = Sum s, e, S (i) = exp | - | S (j, k) – S (o) | (exp 2) / (2 || W (k) (:, j) ||

.....and S (i) is a set of constellation symbols whose bit representations contain the given value of the bit of interest B (I, k).

46. The following is an examiner's statement of reasons for allowance: the prior art (6771706, 6747948, 6850481, 20030072254, 20020122381, 20030003880, 6771706, 20020191703) of record does not appear to teach or render obvious the claimed limitations in combination with the specific added limitations, as recited from independent claim 23: "demodulating the received multi-antenna transmission signals to recover data bits from bit metrics computed by using a minimum mean squared error bit metric estimator represented by.....and S (i) is a set of constellation symbols whose bit representations contain the given value of the bit of interest b (l, k).

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHUONG T. HO whose telephone number is (571) 272-3133. The examiner can normally be reached on 8:00 am to 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Huy Vu can be reached on (571) 272-3155. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

04/12/06

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